

covers all the eight descriptions, if only one function is specified in the latter form.

For written notation we can use capitals and small letters. 'The MSA class of research' would be our class (c) above. It is for this convenience that the words subject and aim are used instead of material and object, or subject and object.

Using these notations it is possible to avoid a great deal of ambiguity when industrial research is under discussion, whether inside or outside the ranks of scientific workers. Further shades of meaning could of course be obtained by defining the amount of restriction, beyond the bare positive and negative here used, but it seems quite needless at present to do so.

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### Science and Psychical Research.

PERHAPS I may be permitted to offer a few comments on Dr. R. J. Tillyard's article under this heading in *NATURE* for July 31. Dr. Tillyard's sympathy for the scientific men who take up the study of psychical research, and thus, as he complains, 'lose caste' and undergo persecution from their fellows, may appear pathetic, and his stated determination, in spite of all consequences, to join the noble army of martyrs, may even seem heroic. He may take comfort, however, in the reflection that, after all, Crookes's spiritualistic activities did not prevent him from attaining to that highest of scientific positions, the presidency of the Royal Society, nor to-day does Sir Oliver Lodge cease to remain highly honoured amongst all scientific men for his physical investigations, and especially for his pioneer work in wireless telegraphy, nor does he cease to be in the greatest request as an exponent of the most recondite theories in modern physics amongst all the best-known scientific societies and institutions.

Dr. Tillyard appears to be surprised at the attitude towards spiritualism adopted by most scientific men, but surely this is to be explained by just such expositions of the subject as Sir Arthur Conan Doyle's "History of Spiritualism." As Dr. Tillyard himself admits, psychical research is therein "most certainly very unscientifically handled." Indeed, this so-called history is no more a scientific book than its imaginative author's recent spiritualistic novel. It is replete with what has been rather aptly described as "determined credulity," and, like most of the fantastic and amazing literature that emanates from psychic bookshops, it trades on the credulous side of human nature, and especially on the emotions of those who, having lost friends who were dear to them, are distressed at the uncertainty of the survival of human personality, and, like the drowning man in desperation will clutch at any floating straw.

Dr. Tillyard makes light of the fraudulent aspect of spiritualism, and says that fraud exists in all branches of human affairs. I can offer no opinion upon the suggestion of biological fraud to which he refers, but speaking for physics, with which I am better acquainted, I cannot remember any case of such a kind worth mentioning during my lifetime. On the other hand, the whole history of spiritualism simply reeks with fraudulent deception. There appears to have scarcely been a single well-known spiritualistic medium who has escaped criticism of this nature. The pages of Sir Arthur Conan Doyle's book are filled with the achievements of spiritualists against whom fraudulent practices have been alleged, as it would seem to the unbiassed critic, on very convincing grounds, and quite a considerable portion

of the history is devoted to explaining away these unfortunate lapses, the explanation in some cases consisting of the amazing suggestion that though evidence showed that the medium did cheat on certain occasions, on other occasions no signs of cheating on the part of this particular medium could be discovered, and therefore the manifestations produced must be considered to be genuine!

The fact is that the whole basis of spiritualistic investigation, as usually carried out, puts a premium on fraudulent practices. The so-called mediums that appear to be requisite in order to conduct the experiments, seem for the most part to be persons of inferior intelligence and education. Most of them are also needy, and eke out a precarious existence by payments for their services, which payments will only continue so long as they succeed in producing extraordinary manifestations.

Imagine for a moment research in ordinary physics made under such conditions as these, with the physicist unable to carry out his own experiments and make his own observations without dependence on the aid of assistants whose interests were all the time to fake the experiments and thus obtain startling effects, assistants, moreover, whose fraudulent delinquencies when discovered were excused and explained away, as seems to be the usual practice in the case of mediums caught cheating. Could any one have confidence in the accuracy of physical investigations carried out under such conditions?

But, says Dr. Tillyard, "we who have seen these things done under conditions precluding deliberate fraud, are not fools, but in full possession of keen faculties." Does he not know, then, that the experienced medium, just like the expert conjurer, both of whom prescribe to a large extent their own conditions, will fool the observer, however acute and scientific, nearly every time? Did he never, when young, attend at Maskeleyne and Cook's home of mysteries at the old Egyptian Hall in Piccadilly, and did he ever once find out how the marvellous phenomena there shown, admittedly by pure trickery, were produced?

How even the most distinguished scientific men can be deluded is evidenced by the well-known case of the "N" rays, for the discovery of which the French Academy of Sciences presented a gold medal to Prof. Blondlot, who, however, was neither a fraudulent medium nor a conjurer, but a well-known and highly respected physicist, who, as is now understood, was at the time of his discovery unfortunately afflicted by incipient insanity, from which he afterwards died. How the "N" ray myth was for ever exploded was recounted by Prof. R. W. Wood in *NATURE*, and is a case of genuine delusion that in the interests of truth should never be forgotten. It is a warning for all time demonstrating the extreme danger of accepting the objective reality of phenomena which, as is claimed, can only be observed, attested, or produced by particular individuals, such as so-called spiritualistic mediums, and not by all competent persons.

I have recently had some personal experience of spiritualistic methods which show how little reliance can be placed upon the support that Sir Arthur Conan Doyle gives to spiritualistic phenomena. Having read in the *Morning Post* that Sir Arthur had exhibited at the Queen's Hall a photograph purporting to be the ghost of the second Viscount Combermere, who was my uncle by marriage, I remembered that I had seen this photograph shortly after it was taken some thirty-five years ago, and that it bore no recognisable resemblance to the deceased Viscount, whom I had frequently seen and

whose genuine photograph I happened to possess. I therefore publicly challenged Sir Arthur Conan Doyle to reproduce in the *Morning Post* the alleged ghost photograph alongside the genuine portrait, whereupon he appears to have suggested to the editor of the *Morning Post* that the ghost photograph could not be reproduced for technical reasons. This assertion was promptly refuted by the *Daily Sketch*, which—I having meantime obtained a copy of the ghost photograph—reproduced with great perfection both this and the authentic portrait in the issue of that paper for May 28 last. There these reproductions remain as evidence that any one can consult, and as I think all sane persons will admit, form a complete exposure of this particular spiritualistic myth.

*Ex uno disce omnes.*

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40 Chester Square,  
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August 9.

I WOULD like to thank Mr. Campbell Swinton for his letter criticising my article on "Science and Psychical Research" in *NATURE* for July 31 last. With what he says on the subject of spiritualism I agree almost entirely; but I had hoped that my article drew a clear distinction between spiritualism and psychical research. Unfortunately, the two are evidently confounded in Mr. Swinton's mind, though they are as distinct as, let us say, astrology is from astronomy, or alchemy from chemistry. If a physicist thought of taking up astronomy, would he read up a text-book of astrology to gain his first ideas of the subject? Or if he desired to study chemistry, would he begin with a history of alchemy? Yet this is just what such a man would be doing who thought to find in a book like Sir Arthur Conan Doyle's the elements of psychical research. Let me recommend to Mr. Swinton instead the careful perusal of Prof. Charles Richet's work "Thirty Years of Psychical Research."

That I in any way make light of the fraudulent aspect of mediumship I must emphatically deny. I think that the last sentence in the concluding paragraph but one of my article supports this denial. Mr. Swinton's remarks about mediums and psychical experiments show an entire misapprehension of the essentials of the problem. Mediums may be good or bad, just like chemical balances or microscopes. Some of them are below the average level of intelligence, others greatly above it; some may be paid for their services (and why not, when, like everybody else, they have to live?), and some never take a penny for the whole of their life's work.

These things, however, are entirely beside the point. In psychical research the medium is not one of the experimenters, as Mr. Swinton seems to think, but takes exactly the same place as the spectroscope in the study of light, or the microscope in the study of minute forms of life; that is to say, *the medium is the instrument through which the phenomena become objective to the experimenters*. Usually the medium is in deep trance and knows nothing of what is occurring. The only difference between the spectroscope and microscope on one hand and the medium on the other is that one is a man-made mechanism, the other a living being (if, as many materialists aver, both are merely mechanisms, then this difference vanishes). It is easier to control the mechanism than the living being, and that is why more stringent precautions are required in psychical research than in other sciences. If a spectroscope is found to give

untrue results, it is thrown aside and a more trustworthy instrument is substituted; if a medium is found to be fraudulent, then the genuine psychical researcher will not proceed with him, but will endeavour to find a more trustworthy one. The spiritualists may make his apologia if they wish; that is no concern of psychical research.

Of all the great scientific men who have patiently and untiringly studied these phenomena—Crookes, Lodge, Richet, Flammarion, Wallace, Barrett, and others—can Mr. Swinton name a single one who has not become convinced in the end of their genuineness? On the other side we have either (a) some few who, having met with a fraudulent medium at the start, have adopted Mr. Swinton's motto *Ex uno disce omnes*, and have concluded, *without further investigation*, that the whole business was fraudulent, and (b) the great majority of scientific men, who have never experimented in the subject at all, but some of whom, nevertheless, consider themselves quite competent to pass a hasty judgment upon it. My article was simply a plea for a more scientific and logical attitude of mind from this second class. *Ex uno disce omnes* may be good Latin but it is bad logic; the hasty generalisation from insufficient facts is still, as always, the curse of modern science. A great teacher once chose twelve disciples; one of them turned out a fraud and betrayed his master. *Ex uno disce omnes*? Were all the apostles frauds because of Judas' defection? Surely not! If we must have a Latin motto, let us have a logical one, such as *Humanum est errare*; then, remembering that this applies equally well to physics, biology, or psychical research, let us make our dispositions for the detection and elimination of fraud and get on with the work.

If Mr. Swinton is really in earnest in desiring to do this, I would advise him to get into touch with my friend Mr. Harry Price, director of the National Laboratory for Psychical Research, 16 Queensberry Place, S.W. 7, and make an appointment to see over the laboratory. If his inspection proves satisfactory, perhaps he might even care to go further and arrange to be present at a sitting with a genuine medium like Stella C., when he might succeed in discovering the real reason for the peculiar behaviour of the thermograph during the production of psychic phenomena accompanied by cold breezes.

R. J. TILLYARD.

Zurich, Switzerland,

August 17.

#### External Capillary Action.

WHEN a glass tube, 6.5 mm. in external diameter, 5 mm. in internal diameter and of any convenient length, one end of which has been drawn out into the form of a cone 55 mm. long with a hair-like apex 0.1 mm. in diameter and a correspondingly small aperture (Fig. 1 (1)) is filled with water containing, say, 1 per cent. of caustic soda, and held with its point downwards at an angle of 35° above the horizontal, a minute stream of water issues from its aperture, turns round underneath its lip and ascends to a distance of 33 mm. on its outer side in the form of a series of minute, disconnected, elongated globules which appear to encircle it. In flowing upwards these globules gradually lose their identity, and finally coalesce with each other to form a substantial drop at a point where the diameter of the cone is about 2 mm.

The drop encircles the cone symmetrically when the tube is vertical, but hangs from its lower side, as shown in (2) when the tube is held at an angle. After the drop has attained a weight of about 0.0113 gm.